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Subpart F

Reilly Tar & Chemical Corp. Ground Water Management Plan Granite City, Illinois, Facility

Phase I

Prepared for:

Reilly Tar & Chemical Corp.
Indianapolis, Indiana

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1. PURPOSE

Reilly Tar and Chemical Corporation (RTCC) operated an active RCRA-regulated wastewater treatment impoundment and overflow area at its Granite City facility until 1985. The unit has been inactive from 1985 to present, excepting some limited biotreatment activities during 1985 and 1986. Although some wastes have been removed off-site, formal clean closure has never been completed. Consequently, ground-water monitoring has been conducted since 1982, with a finding in 1984 of statistically significant changes in ground-water quality. An ongoing ground-water assessment program has since detected and confirmed ground-water contamination in limited on-site areas.

There is no clear indication of off-site migration of hazardous waste constituents at the Reilly facility. However, rather than to continue only with monitoring in anticipation of a potential off-site release, Reilly believes it is more appropriate to pursue an active approach to ground-water protection. The proposed three phase ground-water management plan is intended to eliminate the potential for off-site releases at levels that may pose a threat to human health and the environment and do so in a manner which combines setting of health assessment-based goals and implementation of realistically achievable technology to meet those goals.

This document presents Reilly's approach in addressing the ground-water situation at the Granite City facility. In addition to a plan of action, this document contains summaries of activities completed to date, including preliminary pumping tests and identification of potential ground-water management technologies which may be applicable in this type of situation.

Ground-water management is an aggressive approach under interim status and is considered integral to the upcoming impoundment closure. Although no specific 35 Ill. Adm. Code, Subtitle G, Part 725, Subpart F regulation exists that requires submission of this type of plan for approval before implementation, Reilly nevertheless desires Agency participation in this process and is submitting this document to IEPA for review and comment prior to initiation of Phase 2 activities.

2. BACKGROUND

2.1 Operation of Waste Management Area

Reilly Tar and Chemical Corporation (RTCC) has operated a coal tar refinery at the Granite City location since 1952. Primary products from the distillation of coal tar have been creosote and electrode pitch. Historically, wastewater generated in the process was treated in an impoundment, later divided into three sections, construction dates and details of which are unknown. Although little is known about the history of the impoundment it apparently was not a formally engineered structure with bottom or side liners to prohibit migration of contents. Construction probably was limited to excavation, placement and grading of available on-site materials. In addition to the treatment impoundment, the hazardous waste management area also consists of a one acre overflow area located to the west of the impoundment. Since construction, the impoundment and overflow areas have undergone many operational changes including phaseout and partial sludge removal as summarized below.

1920 (approximate date)-November 1980

- Untreated plant effluent discharged into wastewater pond.

1970's

- Wastewater pond enlarged to accommodate expanded surface drainage collection from facility.

November 1980 - July 1983

- Discharge of untreated effluent into wastewater pond continues.

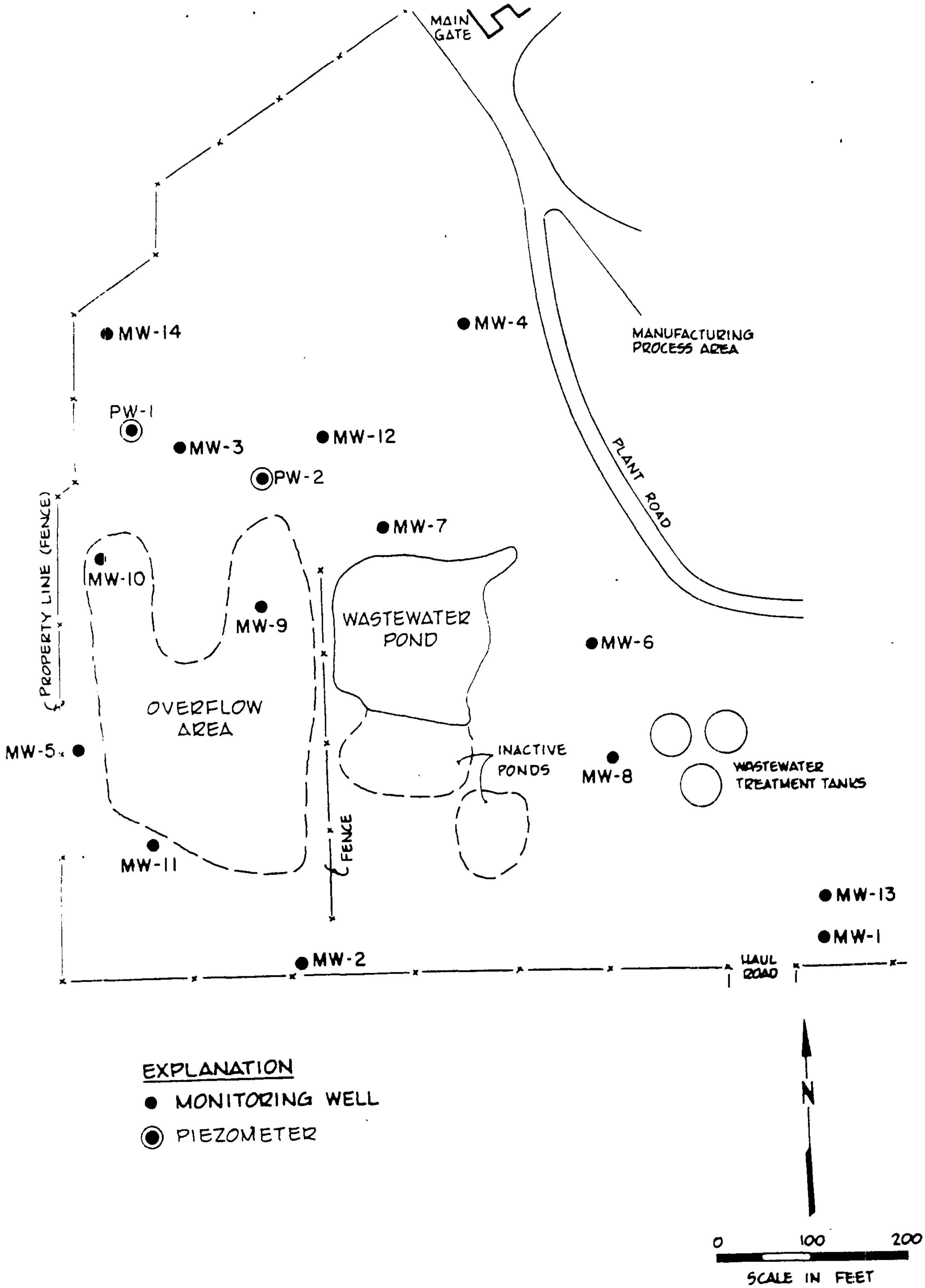

Figure 2-1 Waste Management Area

February 1985 - Present

- Treatment tanks directly connected to municipal sewer system.
- No discharge of wastewater to either the wastewater pond or overflow area.

As indicated above, K035 sludge has been removed off-site from two of the three inactive impoundment sections. In addition, research into possible recycling/reuse options for waste remaining in the third section is ongoing and will be completed by June, 1987. Formal closure of the impoundment area is anticipated to be completed by November, 1988.

2.2 Interim Status Assessment Program

Pursuant to 40 CFR, Part 265, Section 265.90-94 (regulations now effective in Illinois as 35 Ill. Adm. Code, Subtitle G, Part 725, Sections 725.190-194) ground-water monitoring activities were initiated in 1982. Analysis and confirmation of ground-water detection monitoring data indicated significant statistical differences between water quality in background and hydraulically downgradient wells. Consequently, Reilly implemented ground-water assessment monitoring required by 725.193(d)(4) and installed additional monitoring wells to determine:

- the rate and extent of migration of hazardous waste or hazardous waste constituents in the ground water; and

- the concentration of hazardous waste or hazardous waste constituents in the ground water

As a result of assessment monitoring, the presence of hazardous waste constituents (see Section 3) was confirmed and a list of monitoring parameters developed and agreed upon by IEPA. In addition, revisions were made to the monitoring program, including the collection of additional hydrogeologic data and installation of wells at multiple depths. Information collected to date regarding vertical and horizontal flow and nature and extent of contamination indicates the following:

- the facility is underlain by two aquifers, one a shallow alluvial unit overlying the other, a more permeable coarse sand and gravel, which are hydraulically connected;

- direction of ground-water flow in both the alluvial aquifer and the sand and gravel aquifer varies between west and northwest and controlled by the gentle hydraulic gradient across the site.

- low levels (i.e., near detection limits) of contaminants have been detected infrequently in several wells; however, two wells, MW7 and MW9-1, have shown significant levels on a continuing basis; and

- where contaminants are present in on-site wells they appear to be concentrated in the shallow zone.

2.3 Site Hydrogeology

The RTCC Granite City facility is located approximately 2 3/4 miles east of the confluence of the Chain of Rocks Canal and Mississippi River and approximately 1 mile northwest of Horseshoe Lake, which was formed by an abandoned river meander. The site is underlain by alluvial and glaciofluvial fill overlying Mississippian age bedrock. As determined by geologic logs from test borings on the site, the thicknesses of the aquifers range from 15 to 25 feet for the alluvial aquifer and 80 to 100 feet for the glaciofluvial aquifer (American Bottoms Aquifer). The alluvial aquifer is characterized by fine-grained deposits of clay, silt and very fine sand, with a shallow clay unit in the vicinity of wells MW9 and MW7 (see Figure 2-2). The American Bottoms aquifer is composed of coarse-grained sand and gravel fining upwards to medium to fine-grained sand near the contact with the alluvial aquifer (see Table 2-1, which summarizes hydrogeologic data for both aquifers).

The depth to the water table at the site varies seasonally from 5 to 15 feet but is generally 10 feet below the ground surface. Water-table elevation data indicate ground-water flow toward the west and northwest in the shallow alluvial aquifer. Gradients within this aquifer range from 0.0005 (ft/ft) to 0.01 based on water-table elevation data from January 1986 through January 1987. Average flow velocities calculated range from 0.09 to 0.22 ft/day. In the American Bottoms aquifer, ground-water flow is also toward the west to northwest. Gradients within this unit are 0.0001 to 0.001 based on water-table elevation data from January 1986 through January 1987. Calculated ground-water flow velocities range from 1.4 to 14 ft/day. The velocity values calculated for both aquifers are consistent with velocities reported in the 1985 Annual Report.

Water-table elevations are listed in Table 2-2.

Vertical gradients were calculated for January 1987 using ground-water elevation data and vertical distance of separation for each nest of multilevel piezometers. These gradients are listed in Table 2-3 along with vertical gradients calculated for the second half of 1986. Both upward and downward vertical flow directions are indicated by ground-water elevation data from January 1987. Upward vertical gradients occur in wells 8, 10, 11 and 14. Data indicate downward vertical gradients in wells 9, 12, and 13. Gradients range from 0.0008 to 0.0061 (absolute value). Although head differences remain slight,

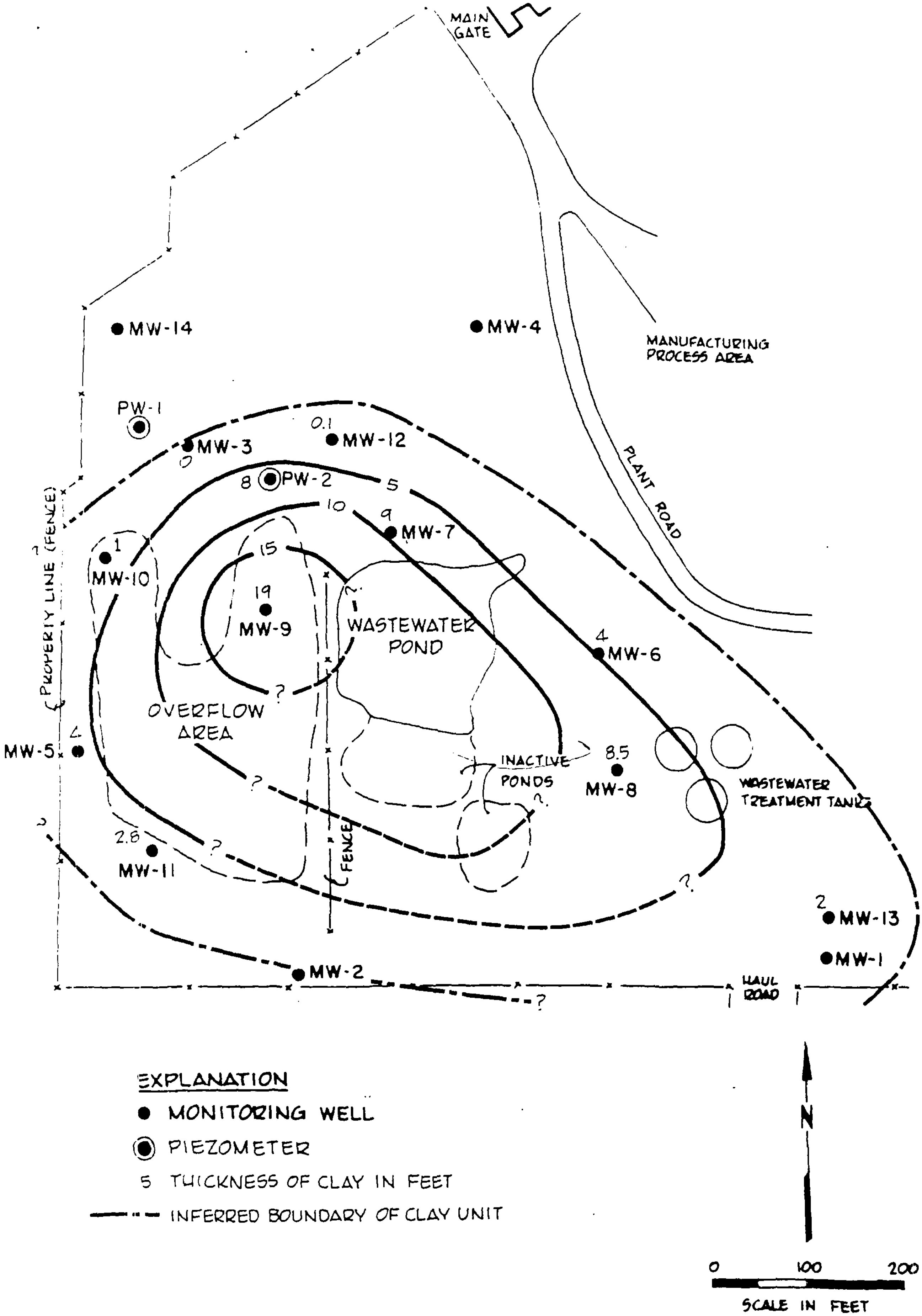

Figure 2-2 Isopach Map of Clay Unit Reilly Tar and Chemical

TABLE 2-1

	Alluvial Aquifer	American Bottoms Aquifer
Aquifer thickness (ft)	15-25	80-100
Hydraulic Conductivity* (ft/sec)	2.29 E-6 - 6.6 E-5	3.28 E-5 - 3.28 E-4
Repr. Hydr. Cond.* (ft/sec)	6.6 E-5	3.3 E-4
Horizontal Gradient (ft/ft)	0.0005-0.01	0.0001-0.001
Ave. Linear Flow Velocity (ft/day)	0.029-0.22	1.4-14
Porosity*	.25	0.10

*Dames & Moore, November 1984, Ground-Water Quality Assessment Report data indicate both upward and downward vertical gradients at the facility.

2.4 Work Completed to Date

2.4.1 Installation of Piezometers

Two new piezometers (PW1 and PW2) were installed at the RTCC Granite City site to measure drawdown during the pumping test on well 3 (as described in following section). Piezometer locations are in the vicinity of monitoring well 3 and are indicated on Figure 2-1. The drilling contractor for the project was John Mathes, Inc. of Columbia, Illinois.

Each piezometer was drilled to a total depth of 20 ft using a 4 1/4" hollow stem auger. Ten feet of 2" I.D., 0.1" machine slot PVC and 12 feet of PVC riser pipe were installed in each borehole. The annular space was backfilled to a depth of 8 feet (2 feet above the top of the screen) using WB-40 sand. ~~A 2 foot~~ bentonite seal was emplaced above the gravel pack, followed by concrete grout. A 5 ft. section of 4" steel casing was cemented in place at each location. Piezometer depths were determined from the interpolation of geologic logs from adjacent wells, specifically wells 3, 7, and 14-1. Based on these data, it was determined that the depth to the top of the medium to coarse sand aquifer should be approximately 21 feet, and the new piezometers were installed accordingly.

2.4.2 Pumping Test #1

The first pumping test was conducted on Well 3 which is screened entirely within the shallow alluvial aquifer. The total depth of the well is 15.5 feet with a screened interval of 5.5 to 15.5 feet. In addition to pumping Well 3, water levels were monitored during the test at distances of approximately 150 ft. (Wells 14-1, 14-2, and 14-3), 50 ft. (Piezometer 1) and 100 ft. (Piezometer 2) from Well 3. A and 14-1. Total drawdown induced in the pumping well was 0.62 feet. The water level in the well stabilized within 15 minutes of pumping. The test was continued for a total of one hour, with no observed drawdown in the observation wells. Because of the relatively high pumping rate of PW1 combined with little drawdown, as compared to Well 3, it seems that the depth to the top of aquifer in this location is likely shallower than anticipated. As further evidence, Piezometer 1 can apparently sustain a much higher yield than Well 3.

The conductivity of the water discharged from the pumping well was also measured. At 15 minutes the conductivity was 750 micromhos. At 40 minutes, the conductivity has increased to 1000 micromhos.

2.4.5 Conclusions

Because of the lack of data obtained from the pumping tests conducted on Wells 3 and 14-1 and Piezometer 1 it is not possible to affirm the feasibility of a ground-water withdrawal system at this time. To pursue this course of action further field tests will be necessary. Although no drawdown data was obtainable from observation wells, some conclusions can be drawn based on the behavior of each pumping well during the tests.

The water level in Well 3 during pumping stabilized within several minutes after pumping began, and recovered almost instantaneously after the pumping was concluded. This suggests that the source of water for the pumping well was not entirely derived from the shallow aquifer but instead may have originated, to some extent, from the underlying medium-coarse grained sand aquifer. As mentioned earlier, no drawdown was observed in PW1, located 50 feet away from MW3. Therefore it is probable that the cone of depression was not extensive laterally due to the vertically upward flow of ground water towards the pumping well.

The purpose of the second pumping test conducted on Well 14-1 was to test the vertical connection between the two aquifers. MW14-2 and MW14-3 were monitored at deeper levels along with PW1. The small amount of drawdown induced in the pumping well (0.42 ft) at a pumping rate of 6 gpm was not great enough to affect the water levels in the deeper monitoring wells. Because of the high hydraulic conductivity of the lower aquifer, a very high pumping rate is necessary to induce a large pumping cone of depression. Any further pumping tests conducted in the lower aquifer would require a submersible pump capable of higher yields and provisions for the large volumes of discharged water.

2.5 Identification of Applicable Technologies

Having identified the problem (shallow ground-water contamination), and knowing the regulatory requirements which ultimately must be met (removal or treatment in place down to specified concentration limits), Reilly can investigate various alternatives with which to conduct ground-water management activities. Prior to a formal evaluation, however, the facility must look at other site-specific factors which can affect the performance of a technology. These include:

- geology/hydrology
- degree/extent/nature of contamination
- engineering feasibility/appropriateness to the situation
- extent to which the technology will protect human health and the environment

Reilly has identified the following technologies which may be applicable either alone or in conjunction with another remedy. Because closure of the impoundment is anticipated by November, 1988 and because closure will not be clean as identified in Section 724.328(a), Reilly proposes to integrate applicable closure requirements with the groundwater management plan. Therefore, capping of "non-clean" sections of the hazardous waste management area is anticipated. Ground-water management options which may be applicable include:

- Ground-Water Pumping (generally used with capping and treatment)

  Function options
  - Extraction and injection
  - Extraction alone
  - Injection alone

  Equipment and material options

  - Well points
  - Pumping wells
  - Injection wells

- Groundwater Treatment

  - Air injection
  - Chemical injection (e.g., H_2O_2)
  - Biological injection (e.g., bacteria which consume contaminants of concern)
  - Air stripping
  - Carbon filtration
  - Treatment in on-site wastewater treatment plant
  - Discharge to sanitary district

- Subsurface Collection Drains

  - French drains
  - Tile drains
  - Pipe drains (dual media drains)

- Vertical Containment Barriers

  Function options

  - Downgradient placement
  - Upgradient placement
  - Circumferential placement

  Material and construction options (vertical barriers)

  - Soil-bentonite slurry wall
  - Cement-bentonite slurry wall
  - Grout curtains
  - Steel sheet piling
  - Vibrating beam

- Horizontal Barriers (bottom sealing)

  - Block displacement
  - Grout injection

- Capping

  - Synthetic membranes
  - Clay
  - Asphalt
  - Multimedia cap
  - Concrete
  - Chemical sealants/stabilizers